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ABSTRACT

The effects of two patterns of teacher behavior on student behavior were investigated, using eight elementary teachers (grades 1-5) and their 250 students. The teacher behavior was conceptualized in terms of the amount of restriction placed on the activities of science students. Fifty students were randomly assigned, with equalizing restrictions on sex and race, to each of the two science classes for each grade level. Both groups at a particular grade level worked with identical materials under very similar physical plant conditions. Prior to the study, the participating teachers were involved in a 6-week workshop designed to train them to exhibit both student-structured learning in science (SSLS) and teacher-structured learning in science (TSLS) behaviors and used the revised Science Curriculum Assessment System (SCAS) Classroom Interaction Categories-Teacher Behaviors, developed and modified by Matthews, Phillips, and Good. Collected data were analyzed using Shymansky's modification of Campbell's macroanalysis technique (chains and codes) to produce 5-tally sequences of behavior. Results indicated that teachers could control their behaviors and that, in a non-directive classroom, students' behaviors were more predictable, less erratic, and more task oriented than in a more directive classroom. (Authors/PEB)

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STUDYING THE EFFECTS OF QUANTITATIVELY DEFINED TEACHING STRATEGIES ON STUDENTS IN ELEMENTARY SCHOOL SCIENCE USING MACRO-INTERACTION ANALYSIS TECHNIQUES

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Abstract

In this study eight elementary teachers in grades one through five and their two hundred-fifty students participated in studying the effects of two patterns of teacher behavior on student behavior during the 1972-73 school year.

The two instructional strategies were quantitatively controlled and conceptualized in terms of the amount of teacher restrictive behavior (giving) directions, and evaluations) exhibited. Teacher and student classroom observational data were analyzed with a modification of Campbell's macro-analytic technique so that five-tally sequences of behavior were revealed.

The results indicate that teachers can control their behaviors and that in a non-directive classroom the students' behaviors are more predictable, less eratic, and more task oriented then in more directive classroom.

The literature of educational research is replete with studies involving teacher effectiveness in natural classroom settings -- studies which have suggested definite cause and effect relationships between teacher variables and student behaviors. Although these studies have uncovered numerous potentially promising areas of research, their almost uniformly inadequate designs and lack of appropriate experimental controls places serious doubts on their findings. In fact, Rosenshine (1970) contends that many of these represent nothing more than correlational data.

To overcome these inadequacies and to establish more clearly the relationship between aspects of instructional strategies and student behaviors demands a more systematic and deliberate control of the related variables. Such control cannot, however, be allowed to overcome the "naturalness" of the classroom atmosphere if we wish to be able to generalize or implement the findings. Specifically, this study was designed to determine how two different teacher behavior patterns affect certain student behaviors in science classrooms.

To answer this, eight teachers and approximately 250 students in grades one through five were involved in a study of two teacher behavioral strategies, referred to as student-structured learning in science (SSLS) and teacher-structured learning in science (TSLS)

METHOD

The Learning Environment

Three factors were considered in determining the SSLS and TSLS strategies. These were: (1) the available materials including written, audio-visual, and

manipulative materials; (2) the teacher's verbal and non-verbal behavior and; (3) the physical plant -- desk space, lighting, classroom, etc. Through careful control of the available materials and physical plant, the SSLS and TSLS teaching strategies were defined solely in terms of teacher behaviors.

The Teacher and Student Sample

The eight teachers, two each from grades one through three and one each for grades four and five, comprised the total population of science teachers in these grades at the Florida State University Developmental Research School. The fifty students at each grade level were randomly assigned, with equalizing restrictions on sex and race, to either of two science classes, one SSLS and one TSLS, prior to the beginning of the 1972 school year.

Both groups of students at a particular grade level worked with identical materials (See Appendix) under very similar physical plant conditions. Time of day was controlled by alternating TSLS and SSLS class meeting times every two weeks beginning the third week of the study.

Teacher Behavior Patterns

Teacher behavior patterns were conceptualized in terms of the amount of restriction placed on the activities of the science students. The revised Science Curriculum Assessment System (SCAS) Classroom Interaction Categories-Teacher Behaviors (Table 1) (Matthews and Phillips, 1968; Matthews, Phillips and Good, 1971) provided more precise definitions of the restrictive behaviors. The four teacher behavior categories which were controlled to establish the

SSLS and TSLS teacher behavior patterns were:

Category 4: Praises or evaluates student for idea or behavior

Category 5: Rejects and/or discourages student behavior

Category 6: Reprimands student for behavior; unpleasant ridicule; criticism; sarcasm

Category 9: Makes statements which tell the student what to do or how to do an activity

The restrictive nature of the categories ranges from overt (category 9) to relatively inconspicuous (category 4). Categories 4, 5, and 6 can, however be used by the teacher to provide a pattern of reinforcement to which the students begin to conform. Such reinforcement and subsequent conformity produce a pattern of student dependency on the teacher's external evaluation (Rogers 1969).

Shymansky's (1972) Learning Conditions Index (LCI) was used to qualify the use of these behaviors. This index, represented by the formula

$$LCI = \frac{\Sigma \text{ frequencies in Categories 4, 5, 6, and 9}}{\Sigma \text{ frequencies in all categories}}$$

combines the number of codes in the four restrictive categories and expresses this as a fraction of the total number of codes during an observational period. The computed LCI can range from 0 (totally non-teacher directed) to 1 (totally teacher directed) and, when multiplied by 100, indicates the percentage of the teacher's time that is spent on directive or restrictive behavior. Category 6 is included in the LCI but its use is discouraged in both the SSLS and TSLS classes.

Rather than establishing the two teacher behavioral patterns at opposite ends of this continuum, the two learning conditions were established at points which a pilot study (Shymansky, 1972) indicated were more representative of natural classroom conditions. Thus, an LCI less than 0.05 defines the SSLS classroom and LCI greater than 0.50 is a TSLS situation. Table 2 contains a summary of the teacher behavior categories and the acceptable percentage range for each behavior under SSLS and TSLS conditions. Thus, the SSLS and TSLS conditions represent contrasting instructional strategies. The SSLS teacher allows the student to engage in science activities which are consistent with the individual cognitive and emotional characteristics of the student. The TSLS teacher, on the other hand, utilizes the characteristics of a specific set of science materials to guide and direct the activity of each student.

In both SSLS and TSLS science, more than ninety-nine percent of the teacher behaviors involve interactions with fewer than seven students -- usually one or two. Therefore, the teacher is essentially roving among students, exhibiting an appropriate behavior which is consistent with the particular teaching strategy. Both SSLS and TSLS are individualized, TSLS being prescriptive and SSLS being non-prescriptive. TSLS teaching narrows alternatives for students to those identified by the teacher as most effective while SSLS teaching maximizes alternatives for students.

Teacher Training

During the summer of 1972, the eight teachers participated in a six-week workshop designed to train them to exhibit both SSLS and TSLS behaviors. In this workshop, the teachers worked with the classroom materials scheduled for use in the project, practiced the SSLS and TSLS behavior patterns, and

coded the behavior of other teachers.

As a result of this training, the teachers were able to conceptualize each of the SCAS behavior categories and exhibit them at will. In addition, the eight teachers learned to be aware of their behaviors prior to exhibiting them. Thus, the teachers were determining how a forthcoming verbal or non-verbal behavior would be coded before they exhibited that behavior. By this means, the teachers were able to fully control their behavioral pattern. To eliminate a within-grade teacher variable, each teacher taught both the SSLS and TSLS science classes on a two-week rotating basis.

During the first four weeks of the 1972-73 school year, each teacher was coded extensively and provided with immediate feedback on her LCI. This practice was continued until pattern stabilization was evident. To further insure consistency, random checks of the LCI by classroom observers using the SCAS instrument were made at various times during the school year.

Classroom Observer Training

All of the observers were either Florida State University Science Education undergraduate or graduate students or faculty. Each of the observers was experienced in the use of classroom observation instruments.

To facilitate consistency in coding skills, extended discussion sessions involving the SCAS categories were held to provide clarification of various points. Coding and re-coding of video tapes and actual elementary science lessons provided further opportunity for the observers to compare observation and coding techniques.

To establish the validity of each observer's coding, each score was compared to the observer trainer's score and an agreement index was computed using the Scott Coefficient, Π (Flanders, 1965).

Data Collection and Analysis

Prior to the study, a data collection schedule was generated with students randomly selected for observation each science period. For twelve weeks following an initial four-week stabilizing period, at least one observer was in every class each day. Student observational data after January, 1973, were collected during two intensive observational periods--one in March and the other in late May. The student data in this report represents the March and May collections only, and was collected with the Science Curriculum Assessment System Classroom Interaction Categories -- Student Behaviors (Table 3) (Matthews and Phillips, 1968).

Teacher observational data was collected from each teacher on a random basis by a trained teacher observer. Teacher data in this study were collected after January, 1973. SCAS observations for both students and teachers were collected as a series of two-place codes at three-second intervals. For teacher observations the two-place code simultaneously records the number of students the teacher is interacting with and which of ten behavior categories is being exhibited. The student SCAS is very similar and uses a two-place code to record whether the exhibited behavior is lesson-related or non-lesson-related and which of ten categories is appropriate.

The collected data were analyzed with Shymansky's (1974) modification of a relatively new technique, macroanalysis (Campbell, 1973). Macroanalysis uses chains of codes and deals with longer sequences of classroom events then conventional ordered pair matrix analysis.

Since macroanalysis deals with sequences rather than pairs, more data is preserved and a better picture of the classroom atmosphere is produced. In this study we chose to look at five-tally sequences representing fifteen-

second intervals. Shymansky's modification of Campbell's technique involves a collapsing of repetitive codes into one code. By this technique, the sequence XXAXXXDDXX becomes XAXDX rather than XXAXX, XAXXX, AXXXD, XXXDD, XXDDX, and XDDXX. Table 4 lists the fifteen most frequent patterns of teacher behavior identified by the modified macroanalysis in both the SSLS and TSLS classes. Table 5 lists the same data for student behavior patterns.

RESULTS

Teacher Behaviors

A quick glance at Table 4, based on approximately 6,000 codes, reveals and validates the dramatic difference between the SSLS and TSLS treatments. None of the fifteen most frequent TSLS modified sequences -- sequences where repititive codes have been eliminated -- are lakcing either a 4 (praise) or a 9 (directions) code. Only one, number nine, contains a code (3, accepting) which is encouraged in the SSLS class. In fact, the same thing could be said of the forty-four most frequent, for only on the forty-fifth sequence does a non-TSLS sequence (S2 S3 S7 S2 S3) come in.

The SSLS sequence, on the other hand, does not present a TSLS code until the thirty-first sequence when a 9 appears. Thus, it is obvious that not only are the TSLS and SSLS teachers exhibiting different behaviors for differing lengths of time, but they are presenting these behaviors in different arrangements and combinations.

It should also be noticed that the TSLS teachers maintained their conditions by means of giving directions (9), observing (2), and then praising or providing positive evalustion (4). These TSLS teachers were seen as warm, personal, and individualizing, not mean. Rejection (5) and reprimands (6) were rare in these classes.

The SSLS teachers created their classroom climates with questions (7), observing (2), and acceptance without evaluation (3). The cyclical and repetitive nature of these behaviors can be seen in the alternating of various codes such as 7, 3, 4 or 9 with 2 codes. Thus, there is essentially no difference in the SSLS aequences S2 S7 S2 S7 S2 (No. 1) and S7 S2 S7 S2 S7 (No. 2) or in TSLS sequences S9 S2 S9 S2 S9 (No. 1) or S2 S9 S2 S9 S2 (No. 2). Both SSLS and TSLS teachers were obviously quite consistent in their behaviors and a good deal of evidence is presented to substantiate the validity of the differences between the SSLS and TSLS treatments.

Student Behavior

Modified macroanalysis of over 15,000 student behavior codes identified several thousand different five-tally patterns. Several interesting findings appear among these patterns.

Although students in both the SSLS and TSLS classes exhibited about the same amount of non-lesson related (N) behavior (between 9% and 10%), differences exist in the frequency of the occurance of N behaviors in patterns. In the SSLS science classroom, the fifty most frequent student behavior sequences contain no N behavior while in the TSLS class, N behaviors appear in the sixteenth sequence, and are common thereafter.

Among the first fifteen SSLS sequences only categories 3 (doing an activity of his own design), 7 (receives ideas from another student), and 9 (gives ideas to another student), are present. The two most predominate patterns, accounting for 10.5% of the codes, consist of students doing an activity, receiving ideas from another student by watching or listening, and then returning to doing their own activities. Copying behavior, category 8, is not present here. The remainder of the top fifteen SSLS sequences show various arrangements of these three codes.

The TSLS science class shows fairly similar patterns except that students are not doing an activity of their own. They are primarily following the teachers directions (2), receiving ideas from other students (7), and giving ideas to other students (9). One other major qualitative difference exists between the SSLS and TSLS students -- sequences 4 and 12, accounting for 1.6% of the total TSLS codes, indicate that students frequently alternated following directions (2) with watching the teacher or a student who was demonstrating for the teacher (1).

If we look at the percentage total codes accounted for by the fifteen most frequent TSLS sequences, it is readily apparent that the TSLS students exhibited many more patterns to account for a majority of the codes then did the SSLS students. From this it can be concluded that TSLS student behavior was more eratic and less predictable. In fact, the first two SSLS sequences, which are essentially identical, represent almost as many codes as the first fifteen TSLS sequences.

In research of this type one criticism frequently arises. That is, if the students in the SSLS class are given no directions then the students cannot exhibit behavior number 2 (following directions). Such critics would then say that the sequences L3-L7-L3-L7 and L2-L7-L2-L7 are not different except by definition. If this were the case, you would expect the students in the SSLS class to exhibit specific behavior patterns in the same proportion as students in the TSLS class if you ignore the distinction between L2 and L3 behavior. The "Test for Significance of Difference Between Two Proportions" (Bruning and Kintz, 1968) reveals that the proportion of time spent on L3-L7-L3-L7-L3 plus L7-L3-L7-L3-L7 patterns in the SSLS class is significantly different (at $\alpha = .05$)

than the proportion of time spent by TSLS students on L2-L7-L2-L7-L2 plus L7-L2-L7-L3-L7 patterns (Table 6). Other less frequent patterns were not found to exist in differing proportions, or did not have similar patterns in both SSLS and TSLS classes.

DISCUSSION

One very important aspect revealed by this study is that teachers can successfully modify and control the amount of time they spend exhibiting specific behaviors while producing what appears to be meaningful, consistent patterns of behavior.

Among the student behaviors, it can be considered as highly significant and informative that in the SSLS classroom, where the teacher removes virtually all restrictions on intellectual behavior and provides no directions, the students:

(1) exhibit fewer patterns containing non-lesson related behavior,

(2) produce fewer patterns of behavior in general, and

(3) exhibit behavior patterns that are far more predictable

than in the TSLS science classroom were directions and evaluation are provided.

In addition, it should be noted that SSLS students do not as often exhibit patterns involving watching the teacher. Thus, it may be concluded that SSLS science students are more involved in the lesson than are TSLS science students. This involvement, since it is not produced by teacher directions or shaping, consists of students identifying problems and solving them in their own way. As they proceed, they are given the opportunity to interact and receive ideas freely, an important aspect of fostering creativity, responsibility, and independence in inquiry.

The implications for schools are great. It appears that providing an open, non-directive classroom atmosphere leads to more responsible, independent students, and a classroom atmosphere that closely approaches many verbalized goals of science teaching. Since it may easily be seen that much (50%) of the TSLS teacher's classroom time is spent providing directions and evaluation without a concomitant increase in student behavioral predictability and since SSLS students are more predictable and are exhibiting desirable behaviors, it can only be concluded that teachers providing a pattern of restrictive behavior are not only wasting their time, they are making things worse.

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Table 1

SCAS (1971) CLASSROOM INTERACTION CATEGORIES - TEACHER BEHAVIORS*

Interacts with sub-groups less than 7 children (S)		Interacts with total group; more than 6 children (T)
S0	miscellaneous	T0
S1	does not observe student behavior	T1
S2	observes student behavior but does not respond	T2
S3	accepts behavior without evaluating	T3
S4	praises or evaluates student for idea or behavior	T4
S5	rejects and/or discourages student behavior	T5
S6	reprimands student for behavior; unpleasant ridicule, criticism; sarcasm	T6
S7	asks questions (which do not tell the students what to do)	T7
S8	gives information which does not tell the student what to do or how to do an activity	T8
S9	makes statements (including questions) which tell the students what to do or how to do an activity	T9

* Matthews, Phillips and Good, 1971.

Revised edition in print.

Table 2

Acceptable Range of SSLS and TSLS Teacher Behaviors

Behavior Category		Percentage of Class Time Permissible in Each Category	
		SSLS	TSLS
1	does not observe	< 1%	< 1%
2	observe student behavior	40-60%	20-40%
3	excepts behavior	10-20%	1-2%
4	praises or evaluates	1-2%	10-20%
5	rejects	1-2%	10-20%
6	reprimands	< 1%	< 1%
7	ask question's	20-40%	15-30%
8	gives information	1-5%	1-5%
9	gives directions	1-2%	20-40%

Table 3

SCAS (1971) CLASSROOM INTERACTION
CATEGORIES - STUDENT BEHAVIORS*

Lesson Related (1)		Non-Lesson Related (N)
L0	miscellaneous	N0
L1	observes teacher or student who demonstrates for teacher	N1
L2	Follows teacher's directions as to what activity should be done and/or how the activity should be done	N2
L3	Does not follow any specific teacher direction; does an activity of his own design	N3
L4	responds to teacher question or request by telling or showing	N4
L5	initiates (or attempts to initiate) interaction with teacher; continues self-initiated interaction with teacher	N5
L6	initiates interaction with another student	N6
L7	receives ideas from another student (who is not demonstrating for the teacher)	N7
L8	copies other student (or follows instructions of other student); (must be preceded by 7)	N8
L9	gives ideas to another student (not at the request of teacher)	N9

* Matthews, Phillips and Good, 1971
Revised edition in print.

Table 4

Most Frequent Behavior Sequences In

	SSLS Science				TSLS Science		
Order	Pattern	Frequency	Percentage	Order	Pattern	Frequency	Percentage
1	S2 S7 S2 S7 S2	58	13.2	1	S9 S2 S9 S2 S9	13	3.6
2	S7 S2 S7 S2 S7	40	9.1	2	S2 S9 S2 S9 S2	12	3.4
3	S2 S7 S2 S3 S2	26	5.9	3	S2 S4 S9 S2 S4	9	2.5
4	S2 S3 S2 S7 S2	21	4.8	4	S9 S2 S4 S9 S2	8	2.2
5	S7 S2 S7 S2 S3	20	4.5	5	S4 S9 S2 S4 S9	7	2.0
6	S7 S2 S3 S2 S7	14	3.2	6	S2 S4 S2 S4 S2	5	1.4
7	S3 S2 S7 S2 S3	11	2.5	7	S2 S4 S2 S7 S2	4	1.1
8	S7 S2 S3 S7 S2	10	2.3	8	S2 S7 S2 S4 S2	4	1.1
9	S2 S3 S7 S2 S7	9	2.0	9	S2 S9 S2 S3 S9	4	1.1
10	S3 S7 S2 S7 S2	9	2.0	10	S4 S9 S2 S9 S2	4	1.1
11	S7 S2 S3 S2 S3	9	2.0	11	S2 S4 S9 S2 S9	3	0.8
12	S2 S3 S2 S3 S2	8	1.8	12	S2 S5 S2 S4 S2	3	0.8
13	S2 S1 S2 S1 S2	7	1.6	13	S2 S9 S2 S4 S2	3	0.8
14	S2 S7 S2 S3 S7	7	1.6	14	S4 S2 S4 S2 S4	3	0.8
15	S1 S2 S1 S2 S1	7	1.6	15	S4 S9 S2 S4 S2	3	0.8

Table 5

Modified Macroanalysis of Student Data

Most Frequent Behavior Patterns In

SSLS Science				TSLS Science			
Order	Pattern	Frequency	Percentage	Order	Pattern	Frequency	Percentage
1	L3 L7 L3 L7 L3	263	5.7	1	L2 L7 L2 L7 L2	70	1.5
2	L7 L3 L7 L3 L7	221	4.8	2	L2 L7 L9 L2 L7	53	1.1
3	L3 L9 L3 L9 L3	89	1.9	3	L9 L2 L7 L9 L2	48	1.0
4	L9 L3 L7 L3 L7	84	1.8	4	L2 L1 L2 L1 L2	46	1.0
5	L9 L3 L7 L9 L3	77	1.7	5	L7 L2 L7 L2 L7	42	0.9
6	L3 L7 L9 L3 L7	74	1.6	6	L2 L9 L2 L9 L2	40	0.8
7	L3 L9 L3 L7 L3	71	1.5	7	L9 L2 L7 L2 L7	39	0.8
8	L3 L7 L3 L9 L3	64	1.4	8	L7 L9 L2 L7 L9	35	0.7
9	L9 L3 L9 L3 L9	63	1.4	9	L2 L9 L2 L7 L2	32	0.7
10	L9 L3 L9 L3 L7	62	1.3	10	L7 L9 L2 L7 L2	31	0.7
11	L3 L7 L3 L7 L9	57	1.2	11	L2 L7 L2 L9 L2	29	0.6
12	L7 L9 L3 L9 L3	54	1.2	12	L1 L2 L1 L2 L1	28	0.6
13	L7 L3 L7 L99L3	52	1.1	13	L2 L7 L2 L7 L9	28	0.6
14	L9 L7 L3 L7 L3	49	1.1	14	L9 L2 L9 L2 L9	25	0.5
15	L3 L7 L9 L3 L9	48	1.0	15	L7 L9 L7 L9 L7	24	0.5

Table 6

Test for Significance of Difference Between Two Proportions: SSLS Sequences vs TSLS Sequences

Order	SSLS Patterns	%	order	TSLS Patterns	%	
1.	L3 L7 L3 L7 L3	5.7	1.	L2 L7 L2 L7 L2	1.5	*
2.	L7 L3 L7 L3 L7	4.8	5.	L7 L2 L7 L2 L7	0.9	
3.	L3 L9 L3 L9 L3	1.9	6.	L2 L9 L2 L9 L2	0.8	
9.	L9 L3 L9 L3 L9	1.4	14.	L9 L2 L9 L2 L9	0.5	
4.	L9 L3 L7 L3 L7	1.8	7.	L9 L2 L7 L2 L7	0.8	
5.	L9 L3 L7 L9 L3	1.7	3.	L9 L2 L7 L9 L2	1.0	
6.	L3 L7 L9 L3 L7	1.6	2.	L2 L7 L9 L2 L7	1.1	
7.	L3 L9 L3 L7 L3	1.5	9.	L2 L9 L2 L7 L2	1.7	
8.	L3 L7 L3 L9 L3	1.4	11.	L2 L7 L2 I9 L2	0.6	
11.	L3 L7 L3 L7 L9	1.2	13.	L2 L7 L2 L7 L9	0.6	

* The indicated comparisons were significantly different at the $\alpha = 0.05$ level.

APPENDIX

Summary of Science Topics Grades 1 - 5

Activity Topic	Materials
Shapes	paper shapes (circles, squares, triangles, parallelograms, etc.) scissors, crayons colored paper.
Pattern Blocks	ESS Pattern Blocks, outlines of figures
Cusenaire Rods	rods, "train" outlines, area outlines,
Balances	pan balances, variety of items for balancing
Color combinations	colored liquids, colored plastic, papers, eye droppers, plastic dishes.
Structures	plastic straws, tooth picks, glue, string plasticene, gol. tubes.
Volume	containers, liquids, cubes, cuisenaire rods, plexiglass containers.
Measures	paper tape, string, marked and unmarked rule meter sticks.
Maps	measuring devices, indoor and outdoor areas for mapping.
Plants	various seeds, soils, and containers for growing plants
Sounds	rubber bands, tape recorders, recorded sound other devices for making sounds
Tangrams	ESS tangrams peice with accompanying outlines, paper, pencil, crayons.
Symmetry	ESS mirror cards
Geo-Blocks	ESS Geo-blocks
Mobiles	string, coat hangers, paper, gule, assorted paper objects for hanging
Insects	gallon milk containers, assorted local insects.

APPENDIX
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Activity Topic	Materials
Mystery powders	white powders (suger, flour, baking soda, etc.) various liquids, candle, foil, clothes pin.
Temperature	hot plates, candles, ice cubes, thermometers
Small things	microscopes, hand lenses, assorted small objects.
Liquids	assorted liquids of varying density, viscosity color, eye droppers, wax paper, containers
Magnets	magnets (horseshoe, bar, ball) paper clips other selected materials (magnetic and non-magnetic)
Lights and Shadows	light sources (overhead projectors, film strip projectors, etc.) two-d mensional and three dimensional shapes.
Air	balloons, plastic straws, string.
Batteries, Bulbs, Wires	Assorted sizes of batteries, bulbs, and wires, bells, switches, tape.